VOLUME 28 1993

# BULLETIN (NEW SERIES) OF THE AMERICAN MATHEMATICAL SOCIETY

**EDITORS**

Richard S. Palais, *Research-Expository Papers*
Murray Protter, *Book Reviews*
Frank Quinn, *Research Announcements*

**ASSOCIATE EDITORS**

Gregory L. Cherlin
Persi Diaconis
William G. Dwyer
Charles L. Epstein
Daniel S. Freed
Michael D. Fried
Zoltan Furedi
Jerry L. Kazdan
Harry Kesten
Robert Lazarsfeld
Barry Mazur
Paul S. Muhly
Jeffrey Rauch
David A. Vogan, Jr.
Alan D. Weinstein
Guido L. Weiss

PROVIDENCE, RHODE ISLAND USA

ISSN 0273-0979

**Bulletin (New Series) of the American Mathematical Society**

This journal is devoted to articles of the following types:

Research-Expository Papers

These are, by definition, papers that present a clear and insightful exposition of significant aspects of contemporary mathematical research. Gibbs lectures, Progress in Mathematics lectures, and retiring presidential addresses will be included in this section.

Research Announcements

The purpose of this department is to publish quickly and disseminate widely significant new mathematics. A Research Announcement should be designed to communicate its contents to a broad mathematical audience and should meet high standards for clarity as well as mathematical content.

Book Reviews

Book Reviews are accepted for publication by invitation only. Unsolicited manuscripts will not be considered.

---

**Subscription information.** *Bulletin (New Series) of the American Mathematical Society* is published quarterly. Subscription prices for Volumes 28 and 29 (1993) are $217 list, $174 institutional member, $130 individual member. The subscription price for members is included in the annual dues. A late charge of 10% of the subscription price will be imposed upon orders received from nonmembers after January 1 of the subscription year. Subscribers outside the United States and India must pay a postage surcharge of $8.00; subscribers in India must pay a postage surcharge of $13.00. Expedited delivery to destinations in North America $12; elsewhere $21. Beginning in January 1992, the Bulletin will be available from the electronic service e-MATH [**telnet e-MATH.ams.org** (or **telnet 130.44.1.100**). Login and password are **e-math**.]

**Back number information.** For back issues see the *AMS Catalog of Publications.*

Subscriptions and orders should be addressed to the American Mathematical Society, P. O. Box 1571, Annex Station, Providence, RI 02901-1571. *All orders must be accompanied by payment.* Other correspondence should be addressed to P. O. Box 6248, Providence, RI 02940-6248.

**Copying and reprinting.** Individual readers of this publication, and nonprofit libraries acting for them, are permitted to make fair use of the material, such as to copy an article for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews, provided the customary acknowledgment of the source is given.

Republication, systematic copying, or multiple reproduction of any material in this publication (including abstracts) is permitted only under license from the American Mathematical Society. Requests for such permission should be addressed to the Manager of Editorial Services, American Mathematical Society, P. O. Box 6248, Providence, RI 02940-6248.

The appearance of the code on the first page of an article in this journal indicates the copyright owner's consent for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law, provided that the fee of $1.00 plus $.25 per page for each copy be paid directly to the Copyright Clearance Center, Inc., 27 Congress Street, Salem, MA 01970. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.

---

*Bulletin (New Series) of the American Mathematical Society* is published quarterly by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2213. Second class postage is paid at Providence, Rhode Island, and additional mailing offices. Postmaster: Send address changes to Bulletin, American Mathematical Society, P. O. Box 6248, Providence, RI 02940-6248.

Copyright © 1993 American Mathematical Society. All rights reserved.
Printed in the United States of America.
The paper used in this journal is acid-free and falls within the guidelines
established to ensure permanence and durability. ⊗
This publication was typeset using $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX,
the American Mathematical Society's TEX macro system.

10 9 8 7 6 5 4 3 2 1 98 97 96 95 94 93

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY

CONTENTS JANUARY 1993

## Research-Expository Papers

**Homogeneous functions on light cones: The infinitesimal structure of some degenerate principal series representations** *by Roger E. Howe and Eng-Chye Tan* . 1

## Research Announcements

**Factorizations of invertible operators and $K$-theory of $C^*$-algebras** *by Shuang Zhang* 75
**Linkless embeddings of graphs in 3-space** *by Neil Robertson, P. D. Seymour, and Robin Thomas* ..... 84
**A new result for the porous medium equation derived from the Ricci flow** *by Lang-Fang Wu* ..... 90
**Representations and $K$-theory of discrete groups** *by Alejandro Adem* ..... 95
**Möbius invariance of knot energy** *by Steve Bryson, Michael H. Freedman, Zheng-Xu He, and Zhenghan Wang* ..... 99
**Relative $K$-cycles and elliptic boundary conditions** *by Guihua Gong* ..... 104
**Singularities of the Radon transform** *by A. G. Ramm and A. I. Zaslavsky* ..... 109
**Best uniform rational approximation of $x^\alpha$ on $[0, 1]$** *by Herbert Stahl* ..... 116

## Book Reviews

**Finiteness theorems for limit cycles** *by Yu. S. Il'yashenko*—**Reviewed by** *Carmen Chicone* ..... 123
**Quantum physics, relativity and complex spacetime** *by Gerald Kaiser*—**Reviewed by** *Robert Hermann* ..... 130
**Operator algebras in dynamical systems** *by Shôichirô Sakai*—**Reviewed by** *Richard V. Kadison* ..... 133
**Spectral and scattering theory for wave propagation in perturbed stratified media** *by Ricardo Weder*—**Reviewed by** *Calvin H. Wilcox* ..... 137
**Almost free modules. Set-theoretic methods** *by Paul C. Eklof and Alan H. Mekler*—**Reviewed by** *Laszlo Fuchs* ..... 141
**André Weil: The apprenticeship of a mathematician** *by André Weil*—**Reviewed by** *Saunders Mac Lane* ..... 144
**Cycles and bridges in graphs** *by Heinz-Jürgen Voss*—**Reviewed by** *Cecil Rousseau* 147
**Variational methods (Applications to nonlinear PDE and Hamiltonian systems)** *by Michael Struwe*—**Reviewed by** *Jürgen Jost* ..... 149
**Differential topology and quantum field theory** *by Charles Nash*—**Reviewed by** *Daniel S. Freed* ..... 153
**Around Burnside** *by A. I. Kostrikin*; **The restricted Burnside problem** *by Michael Vaughan-Lee*—**Reviewed by** *M. F. Newman and G. E. Wall* ..... 157
**Nonlinear partial differential equations of second order** *by Guangchang Dong*—**Reviewed by** *Gary M. Lieberman* ..... 161
**Introduction to asymmetric solitary waves** *by Juri Engelbrecht*—**Reviewed by** *John Albert* ..... 164
**The linear complementarity problem** *by R. W. Cottle, J. S. Pang, and R. E. Stone*—**Reviewed by** *M. C. Ferris* ..... 169

**Non-abelian harmonic analysis. Applications of $SL(2, \mathbb{R})$** *by Roger Howe and Eng-Chye Tan*—**Reviewed by** *David A. Vogan, Jr.* ..... 176
**Classical recursion theory** *by P. Odifreddi*—**Reviewed by** *J. R. Shoenfield* ..... 182
**The geometry of supermanifolds** *by Claudio Bartocci, Ugo Bruzzo, and Daniel Hernández-Ruipérez*—**Reviewed by** *Alice Rogers* ..... 184
**Banach lattices** *by Peter Meyer-Nieberg*—**Reviewed by** *C. D. Aliprantis* ..... 190
**Mathematical models in electrical circuits: theory and applications** *by C. A. Marinov and P. Neittaanmäki*—**Reviewed by** *A. H. Zemanian* ..... 194
**The theory of subnormal operators** *by John Conway*—**Reviewed by** *T. W. Gamelin* 199
**Combinatorial matrix theory** *by Richard A. Brualdi and Herbert J. Ryser*—**Reviewed by** *W. T. Tutte* ..... 202
**Error analysis in numerical processes** *by Solomon G. Mikhlin*—**Reviewed by** *F. Stummel* ..... 204
**Two-dimensional geometric variational problems** *by Jürgen Jost*—**Reviewed by** *Friedrich Sauvigny* ..... 206
**Additive number theory of polynomials over a finite field** *by Gove W. Effinger and David R. Hayes*—**Reviewed by** *R. C. Vaughan* ..... 209
**Erratum** *by C. D. Hodgson, I. Rivin, and W. D. Smith* ..... 213

## CONTENTS APRIL 1993

### Research-Expository Papers

**An external approach to unitary representations** *by Marko Tadić* ..... 215
**New points of view in knot theory** *by Joan S. Birman* ..... 253
**Wavelet transforms versus Fourier transforms** *by Gilbert Strang* ..... 288
**Prevalence: An addendum** *by Brian R. Hunt, Tim Sauer, and James A. Yorke* .... 306

### Research Announcements

**Integration and approximation of multivariate functions: average case complexity with isotropic Wiener measure** *by G. W. Wasilkowski* ..... 308
**Zariski geometries** *by Ehud Hrushovski and Boris Zilber* ..... 315
**Topology of homology manifolds** *by J. Bryant, S. Ferry, W. Mio, and S. Weinberger* 324
**On the distribution of sums of residues** *by Jerrold R. Griggs* ..... 329
**Borel actions of Polish groups** *by Howard Becker and Alexander S. Kechris* ..... 334

### Book Reviews

**Elements of $KK$-theory** *by Kjeld Knudsen Jensen and Klaus Thomsen*—**Reviewed by** *Jonathan Rosenberg* ..... 342
**Automorphisms and derivations of associative rings** *by V. K. Kharchenko*—**Reviewed by** *P. M. Cohn* ..... 348
**An introduction to wavelets** *by Charles K. Chui*; **Ten lectures on wavelets** *by Ingrid Daubechies*—**Reviewed by** *Yves Meyer* ..... 350
**Scenes from the history of real functions** *by Fyodor A. Medvedev*—**Reviewed by** *Angus E. Taylor* ..... 360
**An introduction to harmonic analysis on semisimple Lie groups** *by V. S. Varadarajan*—**Reviewed by** *Joseph A. Wolf* ..... 367

**Numerical methods for conservation laws** *by Randall J. LeVeque*—**Reviewed by** *John C. Strikwerda* ..... 370
**An introduction to multigrid methods** *by P. Wesseling*—**Reviewed by** *Steve McCormick* ..... 373
**Equivariant surgery theories and their periodicity properties** *by K. H. Dovermann and Reinhard Schultz*—**Reviewed by** *Mel Rothenberg* ..... 375
**Pluripotential theory** *by Maciej Klimek*—**Reviewed by** *J. E. Fornaess* ..... 382
**Analysis of Toeplitz operators** *by A. Böttcher and B. Silbermann*—**Reviewed by** *Thomas Kriete* ..... 387
**Scientific computing and differential equations—An introduction to numerical methods** *by Gene H. Golub and James M. Ortega*—**Reviewed by** *David M. Young* 397
**Chaotic transport in dynamical systems** *by Stephen Wiggins*—**Reviewed by** *Robert W. Easton* ..... 398
**General orthogonal polynomials** *by Herbert Stahl and Vilmos Totik*—**Reviewed by** *D. S. Lubinsky* ..... 403
**Combinatorial homotopy and 4-dimensional complexes** *by Hans Joachim Baues*—**Reviewed by** *John R. Harper* ..... 408
**The geometry of four-manifolds** *by S. K. Donaldson and P. B. Kronheimer*—**Reviewed by** *N. J. Hitchin* ..... 415
**Perturbation methods** *by E. J. Hinch*—**Reviewed by** *James Murdock* ..... 418
**The Stefan problem** *by Anvarbek Meirmanov*—**Reviewed by** *John Ockendon* ..... 421
**Hardy-type inequalities** *by B. Opic and A. Kufner*—**Reviewed by** *Hans P. Heinig* . 423
**Interpolation of rational matrix functions** *by J. A. Ball, I. Gohberg, and L. Rodman*—**Reviewed by** *M. A. Kaashoek* ..... 426